

Sprayed Sealing - Aggregate Precoating

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INTRODUCTION

Precoating of aggregates is used to assist in achieving the initial bond between aggregate particles and binder in hot sprayed sealing work. It is particularly used to overcome potentially adverse effects arising from dust or moisture on aggregates.

Adhesion agents are a further aid to promoting adhesion in the presence of moisture, or to counteract poor affinity between bitumen and certain rock types. They are generally most effective and economical when used in precoating materials, but may also be added to the bitumen binder.

A further factor involved in achieving adhesion between aggregates and binder is binder viscosity at the time of applying aggregate, which is a function of the timing of aggregate application and rolling, pavement temperatures and cutting practice.

A guide to rolling and compaction of aggregates is provided in Pavement Work Tip No. 24.

A guide to sprayed seal cutting practice is provided in Pavement Work Tip No. 14. It is important to appreciate the inter-relationship between cutting practice and aggregate precoating. Standard proportions of cutter are based on an assumption of effectively precoated aggregates and adjustments may be required based on the type and condition of precoat. This should not, however, be interpreted as encouraging use of cutter to compensate for poor precoating, or over-precoating to compensate for lack of cutter.

Aggregates for sprayed sealing work should be as clean as practicable (<2% dust). Where necessary, cleanliness may be improved by careful screening and/or washing. Almost all aggregates contain some dust, often as a result of loading, transporting and being stockpiled, and some moisture. It is therefore strongly recommended that **all aggregates be precoated** to minimise risks associated with poor adhesion and stripping in sprayed seals.

PRECOATING MATERIALS AND PROCEDURES

Precoating of aggregates is used in two major forms:

- Plant precoated aggregates that are stockpiled for later use.
- Field precoating immediately prior to use.

Plant Precoating

Plant precoating is done with bitumen based materials that leave a thin film of bitumen adhering to the aggregate.

These are generally mixtures of bitumen and flux oil with a bitumen content of between 30 and 40% by volume of the mixture, or bitumen emulsions that have been

formulated to provide the appropriate uniform thin coating of bitumen. Bitumen emulsion has the advantage of containing little or no oil that might reduce the early strength of bond as well as being more environmentally friendly.

When using bitumen/flux oil mixtures, it is preferable that precoating is done 1 to 4 weeks in advance of use to allow the material to set up and avoid pick-up by the traffic and/or softening of the binder. Materials may be stockpiled for up to 12 months but may require re-assessment after a period of time, and possibly rejuvenation, before use.

Plant precoating may be done at the quarry prior to delivery, or at the stockpile site. When precoated at the stockpile site, it should be re-stacked neatly to allow economic and efficient loading at the time of use. The precoated aggregate will require protection from dust, which may be done with plastic sheeting, or similar. Stockpile sites should also be managed to avoid environmental damage from precoating materials or activity.

Field precoating

Precoating immediately prior to use is usually done with a flux oil complying with AS 3568 – *Oils for reducing the viscosity of residual bitumen for pavements*. A 50:50 mixture of flux oil and cutter oil, or cutter oil only, may be used in cooler weather conditions to provide more rapid drying, but may evaporate and become ineffective too quickly in warm conditions.

Key Summary

This issue of "pavement work tip" provides a guide to aspects of bitumen sprayer operation and work practices that lead to uniformity and neatness of sprayed seal work.

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Bitumen emulsion, comprising special proprietary grades of low bitumen content emulsion, can also be used for field precoating for immediate use although cleaning of loading equipment can be difficult.

A further form of field precoating involves the use of proprietary mixtures of water and adhesion agent. However, they are rarely used, as they rely on a uniform damp condition to control dust, which is difficult to control, particularly in warm conditions.

Precoating for immediate use should be undertaken in conjunction with loading of spreading trucks, using a loader able to load and precoat in one operation. Materials should be used on the same day as precoating.

PRECOATING APPLICATION RATES

The quantity of precoating material applied should be just sufficient to coat each aggregate particle uniformly. Equipment and procedures used for precoating must also ensure that the material is uniformly applied.

A guide to rates of application on clean, dry aggregates is given in Table 1. Dusty or dirty aggregates require a heavier rate of precoating than clean dry aggregates of the same type and size. For porous aggregates, rates may need to be increased by up to 2L/m³, and for smooth, hard aggregates, reduced by up to 2L/m³, from the values shown in Table 1 (below). Generally, bitumen based materials and emulsions require heavier rates of application than oils.

ADHESION AGENTS

Adhesion agents are used to change the surface chemistry of the aggregate/bitumen interface to improve adhesion in presence of moisture or improve adhesion of aggregates that have a poor affinity for bitumen. Aggregates with poor bitumen adhesion include acidic or quartz rich materials such as quartz, quartzite, granite and some river gravels.

Aggregate Quality	Precoating agent	
	Bitumen based, including bitumen emulsions	Oil
Clean	6 to 12	4 to 10
Dirty	8 to 14	6 to 12

Table 1: Typical precoating rates (L/m³)

Adhesion agents are generally added to the precoating material when aggregates are damp, or the weather conditions are unfavourable with rain threatening or humid conditions.

Oil/bitumen precoating materials used for plant precoating should always contain an adhesion agent.

Use of adhesion agent in binder is generally only necessary when:

- using polymer modified binders,
- using acidic (quartz-rich or siliceous) aggregates, or
- damp aggregates cannot be effectively and uniformly pre-coated.

Adhesion agent materials

Adhesion agents may be supplied as a paste, in granular form, or as a fluid. They often have a pungent smell, and can irritate the skin and eyes. The manufacturer's instructions given in the Materials Safety Data Sheets (MSDS) should be observed at all times.

Concentration

Accurate measurement of quantities of adhesion agent is important for both economy and effectiveness.

Too much adhesion agent can actually make things worse, and result in the aggregate stripping.

Typical concentrations, based on the commonly used adhesion agents, are:

In precoat: 1 to 2 parts, by volume, per 100 parts of precoating materials (approximately 1%)

In binder: 1/2 to 1 part, by volume, per 100 parts of binder (approx. 0.5 to 1%).

CONCLUSION

Laboratory testing and field experience will assist in the choice of preferred precoating material and adhesion agent. Bitumen based materials generally perform better in the long term than oils or water based materials.

Precoating is just one step in the chain of accepted and well established practices, and attention to detail is required to achieve a consistent high quality of sprayed sealing.

Precoating should not be neglected on the basis of using additional cutter in the binder, nor should it be used as a substitute for proper workmanship, or for specifying and accepting any other than clean aggregates.

For more information on any of the construction practices discussed in "pavement work tips", please contact either your local AUSTRROADS Pavement Reference Group rep. or AAPA: tel (03) 9853 3595; fax (03) 9853 3484; e-mail: info@aapa.asn.au.

A complete list of "pavement work tips" issues is available on AAPA's website: www.aapa.asn.au

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